










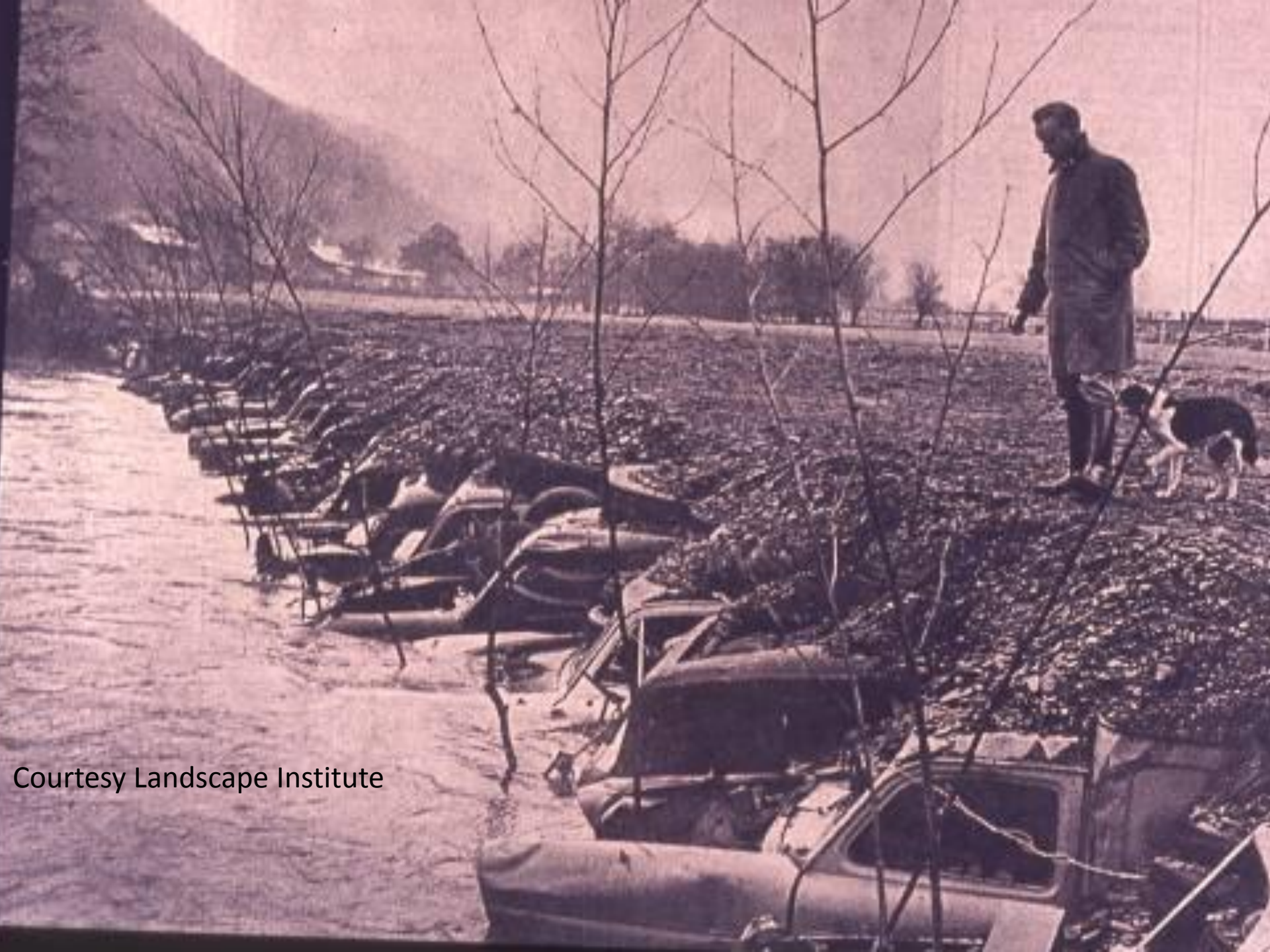


**Portland 1807**  
**Evaporation 40%**  
**Groundwater 50%**  
**Runoff 10%**



**Portland 2007**  
**Evaporation 4%**  
**Groundwater 5%**  
**Runoff 90%**

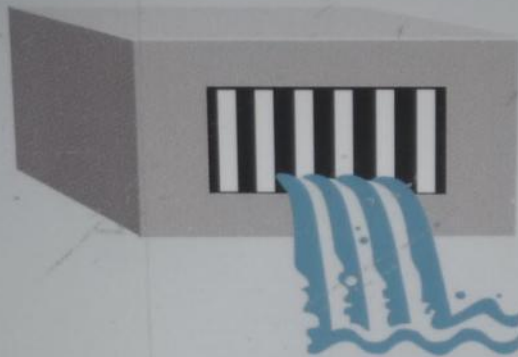




Courtesy Landscape Institute



# HAZARDOUS STORMWATER



## WARNING

STORMWATER MAY  
CONTAIN HIGH LEVELS  
OF BACTERIA  
AVOID SKIN CONTACT

BY ORDER OF SANTA CRUZ COUNTY  
ENVIROMENTAL HEALTH DEPARTMENT



















A photograph of a green roof. On the left side, there is a row of solar panels mounted on a metal frame. The rest of the roof is covered with low-lying green and red vegetation. In the background, there are several white HVAC units and other buildings under a blue sky with some clouds.

**Human Health**

**Aesthetics – well-being**

**Energy  
Conservation**

**Comfort/climate**

**Water management/  
flood prevention**

**Clean air**

**Clean water**

**Biodiversity**

**Local Food**

**Benefits of Green Roofs**



## POTENTIAL LEED CREDITS

SS 5.1 Protect & restore Habitat-20% of total site area (1 pt)

SS 5.2 Maximize Open Space (1 pt)

SS 6.1 Stormwater Design- Quantity Control (1 pt)

SS 6.2 Stormwater Design- Quality Control (1 pt)

SS 7.2 Heat Island Effect- Roof (1 pt)



WE 1 Water efficient Landscaping (1-2pts)

EA PR 2: Minimum Energy Performance

EA 1 Optimize Energy Efficiency (1 pt)

MR 4 Recycled Content (1-2 pts)

MR 5 Regional Materials- (1-2 pts)

MR 6 Rapidly Renewable Materials (1 pt)

ID 1.1- 1.4 Innovation in Design (1 -4 pts)

Regional Priority (1-2 pts)

### Green roof benefits

- Thermal mass
- Prolongs roof life
- Cooler roof temps
- SWM
- Habitat
- Air quality/micro-climate
- Aesthetics
- Life cycle costs



MARYLAND  
NORTHERN CHESAPEAKE BRANCH

2011 Sustainable School Construction Workshop



### wind turbines

The exhaust plenum is at slightly negative pressure, induced by north flues' 'stack-effect' and wind-powered turbines.

### vertical planting

Green north façade and roof top assists shading, glare and air quality.

Access to nature enhances productivity by relieving stress.

### shading + light

Light shelf plus balcony floors provide horizontal shading from northern sun.

Ambient and direct daylight bounces off external and internal light shelf.

### exhaust

High level ceiling exhaust ensures complete emptying of warm air in ceiling spaces.

### chilled ceilings

Chilled ceiling panels absorb radiated heat from equipment and occupants.

Occupants experience 'coolth' by radiating heat to chilled ceilings overhead.

### roof top energy

Includes photovoltaic cells, solar hot water panels and a gas-fired co-generation plant.

### healthy air

100% outside air supply via vertical ducts deliver air floor by floor to sealed access floor plenum.

### thermal mass

Thermal mass in concrete slab absorbs excess heat from the space.

### displacement air

Fresh air fed at low speed through controllable floor vents.

CITY OUTLOOK

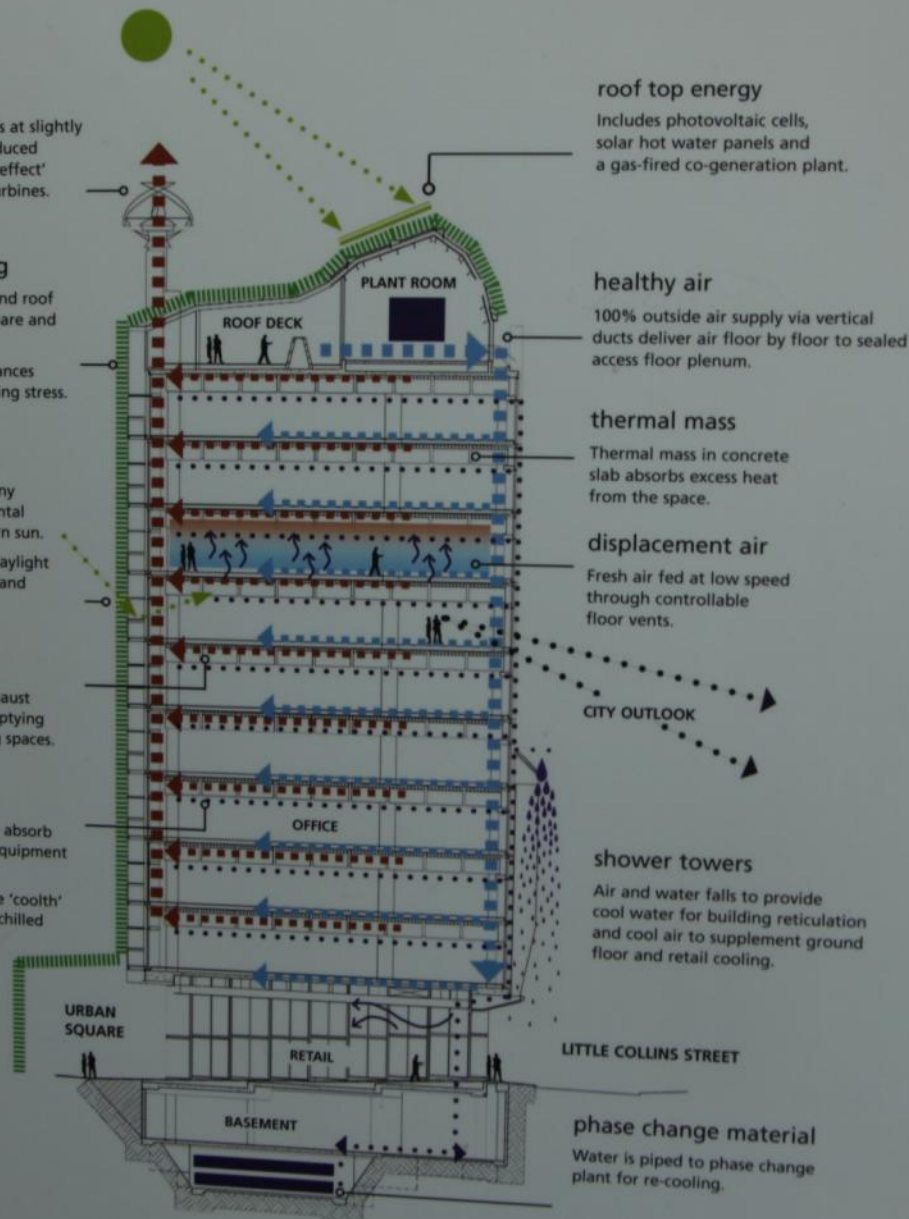
### shower towers

Air and water falls to provide cool water for building reticulation and cool air to supplement ground floor and retail cooling.

LITTLE COLLINS STREET

### phase change material

Water is piped to phase change plant for re-cooling.



BIT CLIMATIC SECTION































# Garden or Machine





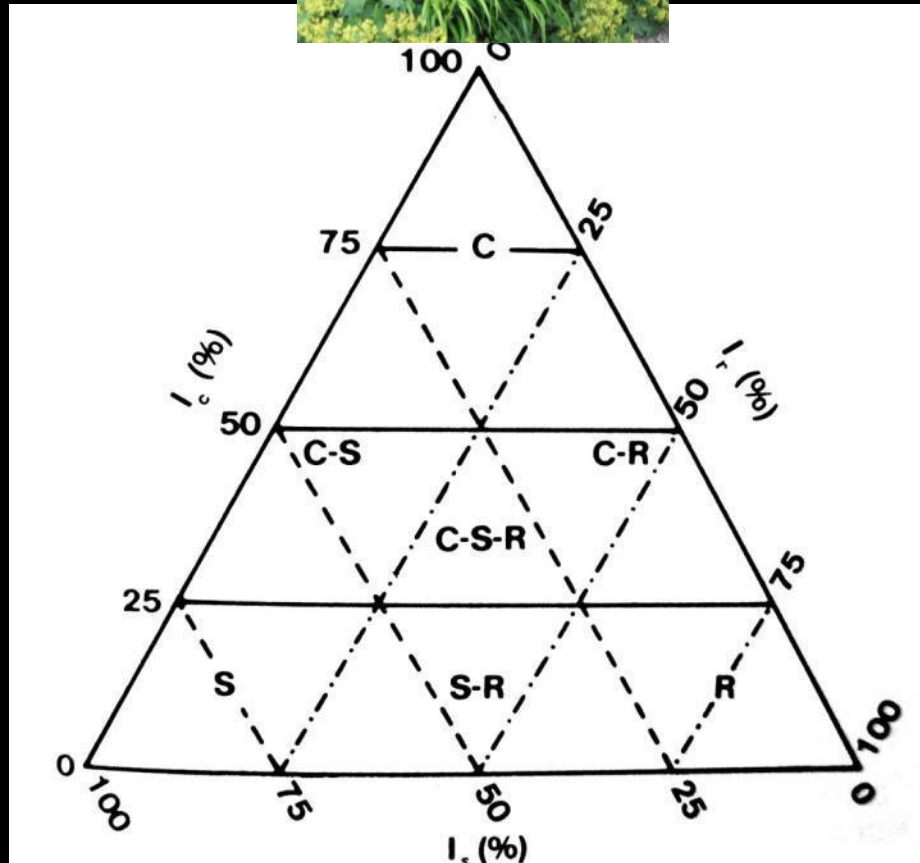
# Triangel of the three ecological strategie types of plants ( Grime 1985)



**Competitors (C)**



**Stress-tolerators (S)**



**Ruderals (R)  
Pioniers  
Disturbance -  
tolerators**

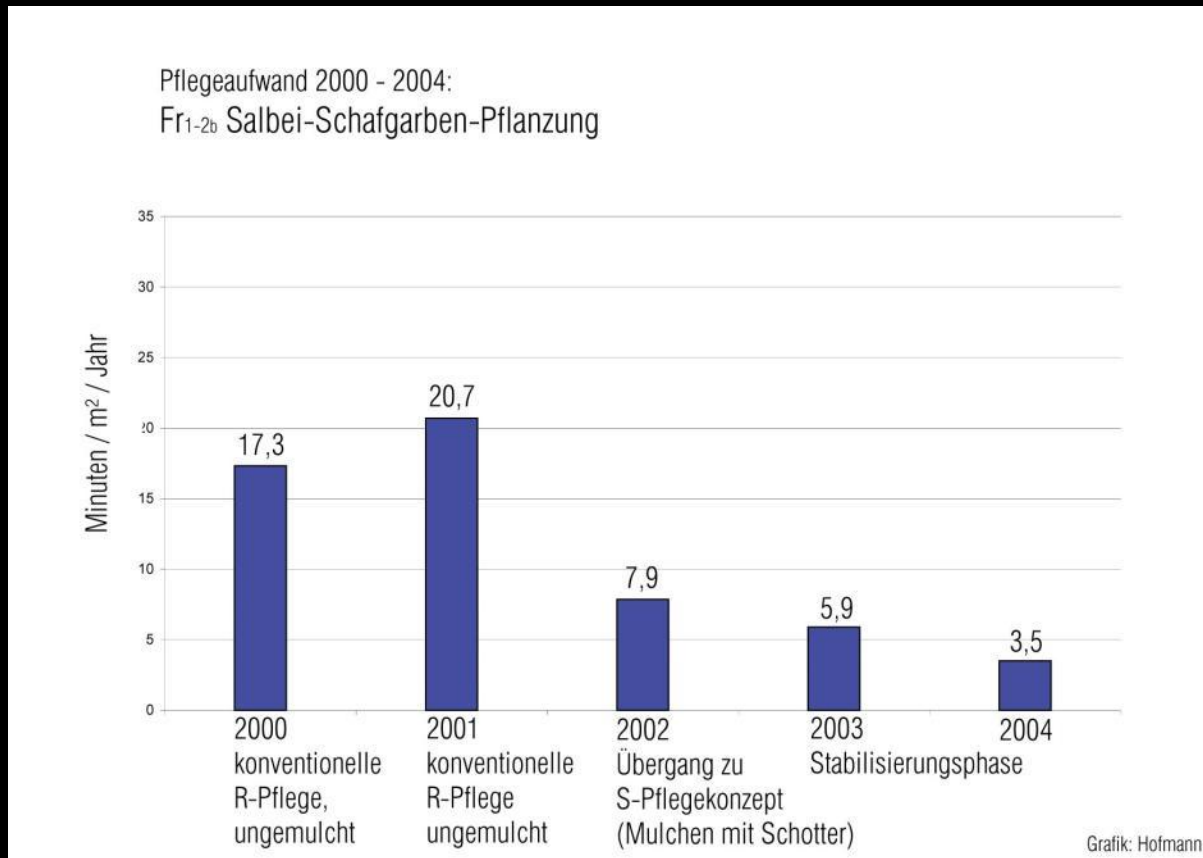




## 3. S-maintenance system for stress tolerant planting types

Example:

**Salvia-Achillea planting**, dry open ground, well drained soil



Improvement of maintenance methods to support a stressful environment:

- Use of machinery
- Mineral mulching
- No irrigation
- No soil disturbance
- No fertilizing









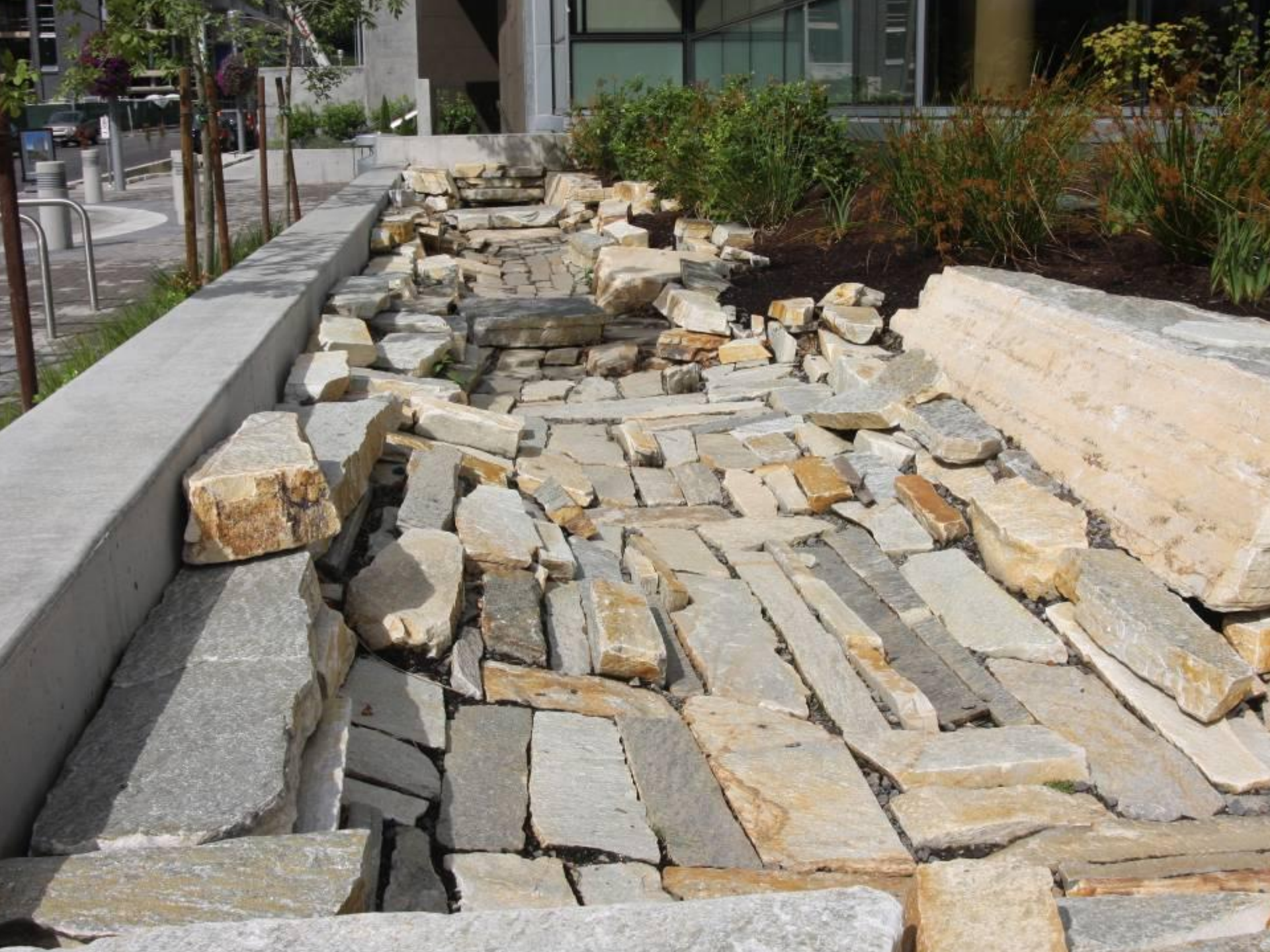
































Central Plant / AOC  
(50,000 sq ft)

Collections Storage  
(135,000 sq ft)

Nitrate  
Vaults  
(55,000 sq ft)

Loading  
Dock

Main Entrance

Conservation Bldg.  
Staff & Preservation Labs  
(175,000 sq ft)





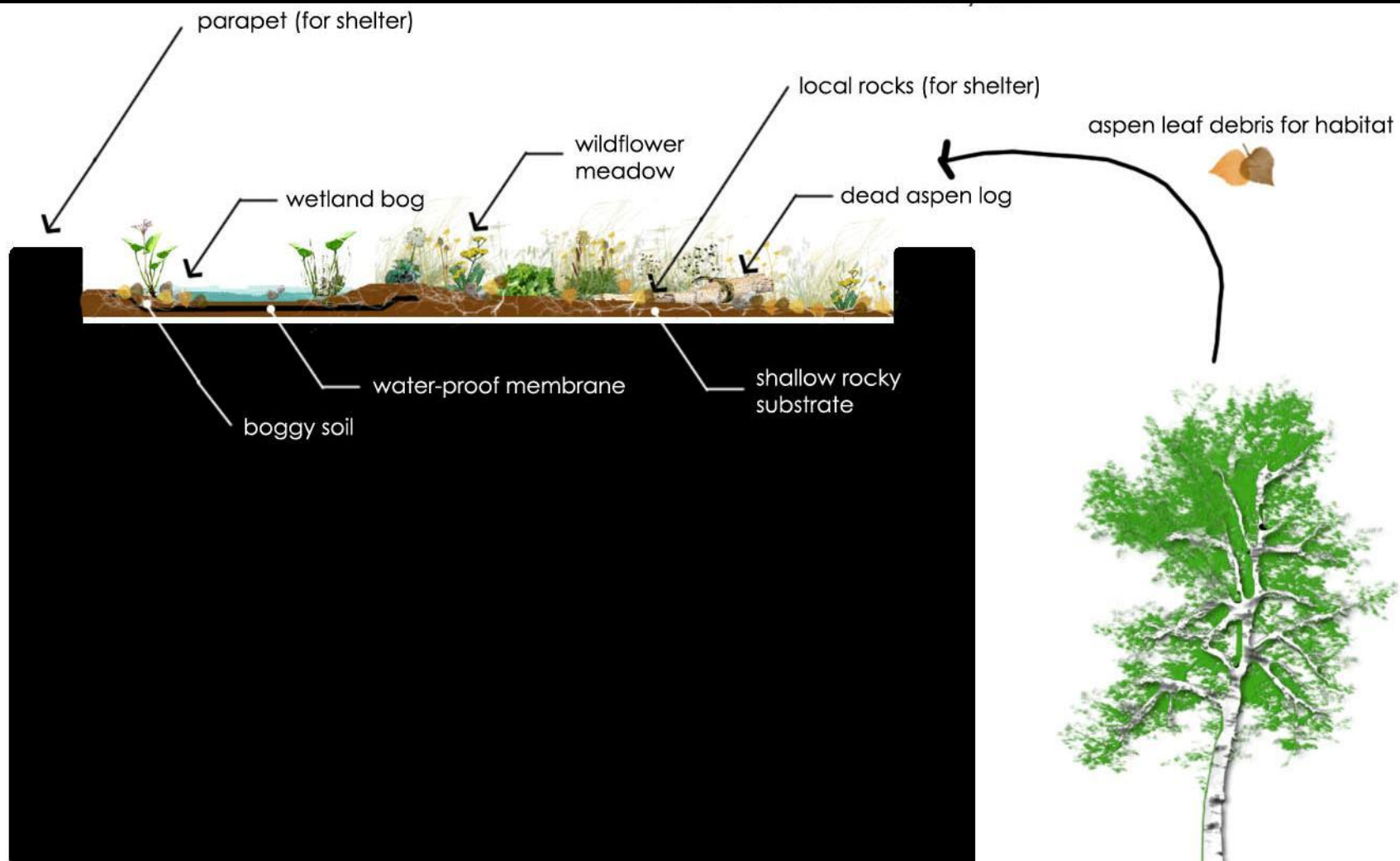




























































































Ride a bike it's cool you'll stay healthy on the way to  
**School!**  
DRAWINGS BY  
AMERICAN CLASS  
CLASS 5  
more reasons to ride visit [www.sustrans.org.uk](http://www.sustrans.org.uk)







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